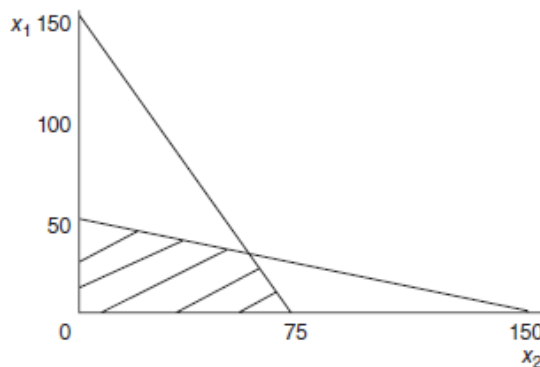# Farm Business Management: The Fundamentals of Good Practice

## Chapter 15: Introducing Further Methods of Farm Systems Analysis (Answers)

1. Graph of the feasible region:



The marginal rate of substitution for the steeper line is −1/3, and for the flatter line is −1/2, as defined by the coefficients in each resource equation. The feasible area is shaded and bordered by the axis and segments of each resource line.

2. The linear programming problem is:

Find the $x$ values that maximize $Z$, the total gross margin:
$$Z = 400x_1 + 200x_2 + 350x_3 + 250x_4$$
Subject to the resource limits expressed in the following equations:
$$100 \geq x_1 + x_2 + x_3 + x_4$$
$$200 \geq 40x_1 + 10x_2 + 18x_3 + 35x_4$$
$$4000 \geq 100x_1 + 35x_2 + 200x_3 + 80x_4$$
And subject to all $x \geq 0$.

3. The slope is the ratio of the net revenues. Thus 100/125, or −0.8 (negative because the slope is backward-facing).

4. Superimposing the iso-profit line on the graph of the feasible area shows the optimal solution is where the two constraint lines meet. Thus:
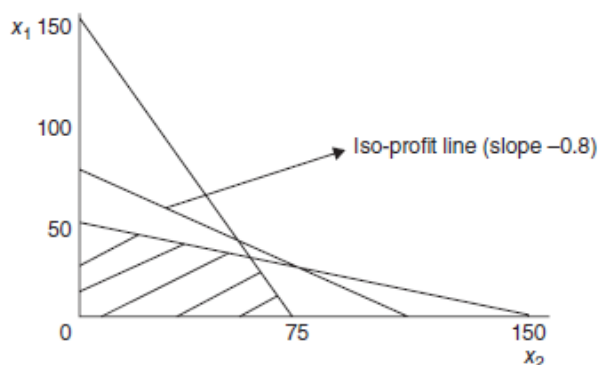
Solving the two equations gives the values of each variable as $x_1 = 30$ and $x_2 = 60$, which means resource use is 300 for the first resource and 150 for the second. Thus, all resource is 'consumed'. The optimal profit ($Z$ value) is 9750.

5. By using a range of activities taken from different positions on the isoquant curves.

6. By using a series of activities each representing a segment on the factor/product curve. However, there is no need to have segments in the increasing returns area, nor the negative returns area.

7. By using a series of activities each one representing one point on the graph showing the $C_j$ decline. Each one must be constrained to its associated maximum.

8. There are few assumptions because any relationship necessary can be defined given the solving process is repetitive sampling. However, there is a practical limit to the size of the model, and it is assumed the experimenter has access to all the knowledge necessary to define all the equations, and is aware of the structure of the problem.